

WHAT IS CLAIMED IS:

1. A multi-layer ceramic capacitor comprising,

a plurality of dielectric ceramic layers, each having first and second layer planes;

a plurality of first internal electrodes provided on the first layer planes of the dielectric ceramic layers and a plurality of the second internal electrodes provided on the second layer planes of the dielectric ceramic layers, the dielectric layers being sandwiched by the first and second internal electrodes; and

a plurality of first and second columnar electrodes penetrating the dielectric ceramic layers in a direction normal to the layer planes of the ceramic layers, the first columnar electrodes being electrically connected to the first internal electrodes and the second columnar electrodes being electrically connected to the second internal electrodes,

wherein the first and second columnar electrodes each has a corrugation including smaller diameter portions and larger diameter portions,

wherein the first internal electrodes are electrically connected to the first columnar electrodes at larger diameter portions of the first columnar electrodes and the second internal electrodes are electrically connected to the second columnar electrodes at larger diameter portions of the second columnar electrodes, and

wherein circumferential edges of the dielectric ceramic layers intrude into the first and second columnar electrodes at the smaller diameter portions of the first and second columnar electrodes, respectively.

2. The multi-layer ceramic capacitor as claimed in claim 1, wherein a plurality of first and second holes penetrating said dielectric ceramic layers are formed by laser, and said first and second columnar electrodes are embedded respectively in the first and second holes.

3. The multi-layer ceramic capacitor as claimed in claim 1, wherein said circumferential edges are rounded or tapered by laser.

4. The multi-layer ceramic capacitor as claimed in claim 1, wherein a difference in diameter between the larger diameter portions and the smaller diameter portions is more than a thickness of the dielectric ceramic layer, the thickness being defined as the distance between the first and second internal electrodes sandwiching the dielectric layer.

5. The multi-layer ceramic capacitor as claimed in claim 1, wherein said columnar electrodes have an aspect ratio of more than 4, the aspect ratio defined as a value of the length of a given columnar electrode divided by the smallest diameter of the smaller diameter portions of the columnar electrode.

6. The multi-layer ceramic capacitor as claimed in claim 1, wherein said columnar electrodes have an aspect ratio of 4-30, the aspect ratio defined as a value of the length of a given columnar electrode divided by the smallest diameter of the smaller diameter portions of the columnar electrode.

7. The multi-layer ceramic capacitor as claimed in claim 1, wherein an average difference between the diameter of the larger diameter portions and the diameter of the smaller diameter portions in said columnar electrodes is about 10-40 micrometers.

8. The multi-layer ceramic capacitor as claimed in claim 1, wherein said columnar electrodes comprise a composite including two metallic grains differing in grain size, an average grain size of one powder being less than $1/3$ of that of the other powder and constituting about 25-70 percent by volume of the material of the columnar electrodes.

9. The multi-layer ceramic capacitor as claimed in claim 1, wherein said dielectric ceramic layers, first and second inner electrodes and first and second columnar electrodes are co-fired to obtain the multi-layer ceramic capacitor.

10. The multi-layer ceramic capacitor as claimed in claim 1, wherein the diameter of the first and second columnar electrodes is about 50-120 micrometers as measured at the smallest diameter thereof.

11. The multi-layer ceramic capacitor as claimed in claim 1, further comprising a plurality of first and second external terminals connected respectively to the first and second columnar electrodes and formed on one external surface of the multi-layer ceramic capacitor but not formed on the other external surface of the multi-layer ceramic capacitor.

12. The multi-layer ceramic capacitor as claimed in claim 1, wherein the larger diameter portions of the first and second columnar electrodes are flange-like connecting portions tapering toward the internal electrodes.

13. A multi-layer capacitor comprising a capacitor body comprising a co-fired laminate of dielectric layers and first and second internal electrode layers which are alternately laminated by mediation of the dielectric layers,

the capacitor body further comprising first and second electrode terminals formed on one main surface of the capacitor body, at least a single first via electrode extending through the capacitor body in the lamination direction of the capacitor body so as to connect the first electrode terminal and the first internal electrode layers, and at least a single second via electrode extending through the capacitor body in the lamination direction of the capacitor body so as to connect the second electrode terminal and the second internal electrode layers,

the via electrodes having an aspect ratio of 4 to 30.

14. The multi-layer capacitor as claimed in claim 12, wherein the via electrodes have a diameter of 50 μm to 120 μm .

15. A method for producing a multi-layer capacitor, comprising:

(a) laminating first and second internal electrode layers by mediation of dielectric layers so as to obtain a capacitor body;

(b) forming a first via electrode extending inward from one main surface of the capacitor body so as to be connected to the first internal electrode layers, and a second via electrode extending inward from one main surface of the capacitor body so as to be connected to the second internal electrode layers; and

(c) firing the capacitor body in which the via electrodes are formed;

wherein the via electrodes in the fired capacitor body have an aspect ratio of 4 to 30.

16. The method for producing a multi-layer capacitor as claimed in claim 15, wherein the via electrodes in the fired capacitor body have a diameter of 50 μm to 120 μm .

17. The method for producing a multi-layer capacitor as claimed in claim 15, further comprising:

(b1) repeating steps (a) and (b) so as to prepare two or more capacitor bodies having first and second via electrodes formed therein;

(b2) bonding two or more of the capacitor bodies in which the via electrodes are formed, such that the first via electrodes of the respective capacitor bodies are connected to one another, and the second via electrodes of the respective capacitor bodies are connected to one another;

wherein, in the step (c), the resultant laminate of the capacitor bodies is fired.